

Physical Activity and Exercise Recommendations for Autism Spectrum Disorders

eTable.
Studies on Improving Autism-Specific Symptoms: Details on Study Design, Participant Characteristics, Intervention Characteristics, Tests and Measures, and Results^a

Study	Study Design	Participant Characteristics		Intervention Characteristics		Majority of the Studies Collected Data at Baseline and Postexercise; Variations Are Mentioned	Majority of the Studies Reported Effects Postexercise; Variations Are Mentioned	Tests and Measures	Results
		N	Age Range (y)	Diagnosis	Time (min)				
Studies targeting problem behaviors									
Elliot et al ⁹¹	W/RM	6	22.8–41.3	Autism+ID	20	Treadmill		Number of maladaptive behaviors	E condition > C condition on amount of improvements
Allison et al ⁹²	SSMB	1	24	Autism	20	logging		Number of aggressive behaviors	Frequency of aggression reduced by 68%
Morrison et al ⁹³	W	4	10–21	Autism	10	Preferred exercise		Number of problem behaviors before, during, and after exercise	2 children reduced problem behaviors
Studies targeting academic and social skills									
Oriel et al ⁵⁷	WC	9	3–6	ASD	15	logging		Number of correct and incorrect responses, stereotyped behaviors, and percentage of time on task	Increase in correct responses postexercise
Nicholson et al ⁵⁶	SSMB	4	9	ASD	12	logging		BOSS scale for on-task and off-task behavior for 15 min at baseline and after exercise	All 4 participants increased on-task behavior
Pan ⁵⁸	W/RM	16	6–9	HFA, ASD	90	Aquatic		HAAR and SSB scales for social skills	Improvement in social skills and aquatic skills
Studies targeting repetitive, stereotypical, and self-stimulatory behaviors									
Anderson-Hanley et al, ⁵⁰ study 1	WSS	12	10–18	ASD	20	Dance Dance Revolution (Nintendo of America Corp, Redmond, Washington)		Frequency of repetitive behaviors during 5 min of play, tests of executive function such as digit span, Stroop, and color trail test	E condition > C condition on frequency of repetitive behaviors and digit span test performance
Anderson-Hanley et al, ⁵⁰ study 2	WSS	10	8–21	ASD	20	Cyber cycling		Frequency of repetitive behaviors during 5 min of play, tests of executive function and working memory using digit span and Stroop test	E condition > C condition on frequency of repetitive behaviors and digit span test performance
Celiberti et al ⁹⁴	SSRR	1	5.75	Autism	6	logging/walking		Amount of stereotypy, self-stimulatory, and out-of-seat behavior at 10-s intervals for 40 min	E condition > C condition, reduced stereotypy and out-of-seat behavior, maximum improvement during first 10 min
Levinson and Reid ⁹⁵	W	3	11	Autism	15	logging		Frequency of stereotypical behaviors seen before, 45 min after, and 90 min after exercise	Stereotyped behavior reduced by 17.5%, gains not sustained after 90 min postexercise

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eTable.
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Study	Study Design	Participant Characteristics			Intervention Characteristics		Tests and Measures	Results
		N	Age Range (y)	Diagnosis	Time (min)	Type		
Kern et al ⁹⁶	W	3	7–11	Autism	15	Jogging	Percentage of stereotyped responding before, immediately after, and 90 min after exercise	E condition > C condition, reduced stereotypy
Prupas and Reid ⁹⁷	WR	4	5–9	ASD, fragile X syndrome	10	Jogging/walking	Percentage of time spent in stereotyped behaviors	Reduction in stereotypy by 51.6% after 1 bout and by 58.9% after multiple bouts
Kern et al ⁹⁸	RR	7	4.75–14.5	Autism	5–10	Jogging	Number of intervals with self-stimulation, number of correct responses during ball playing and academic tasks	Lower self-stimulatory behaviors and more ball playing and academic responding
Watters and Watters ⁹⁹	W	5	9.42–11.58	Autism	8–10	Jogging	Percentage of self-stimulation; percentage of correct answers during exercise, academic, and television conditions	Lower percentage of self-stimulation after exercise but not control activities (academic and television watching)
Powers ¹⁰⁰	SSR	1	8	ID+Autism	10	Roller-skating	Percentage of time spent in self-stimulation and rates of on-task behavior	Lower self-stimulation after roller-skating
Rosenthal-Malek and Mitchell ⁵⁵	W	5	14.1–15.5	Autism	20	Jogging	Number of self-stimulatory behaviors, correct academic responses, and work performance	Lower self-stimulation and more academic responses

^aWRM=within-subjects repeated measures, SMB=single-subject multiple baseline, W=within-subjects crossover, WSS=within-subjects sequential SSR=single-subject replication reversal, RR=repeated reversal, WR=within-subjects reversal, SSR=single-subject reversal, ASD=autism spectrum disorders, ID=intellectual disability, HFA=high-functioning autism, AS=Asperger syndrome, BOSS=Behavioral Observation of Students in Schools, HAAR=Humphries Assessment of Social Readiness, SSB=School Social Behavior Scales, E=experimental, C=control.